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ABSTRACT

This paper describes the development of a web-enabled information service for constituents of the Information Resources Management College (National Defense University, Washington, DC). The constituents of the College, who include graduates, current students, and prospective students, typically work in the Chief Information Officer (CIO) office of United States federal agencies. The Web-enabled information service, known as "Knowledge Net," is intended to tie the College constituents located throughout the world into a virtual community, sharing technical information, emerging problems, and potential solutions. Knowledge Net has evolved over a 3-year span from a skunk-works project of several faculty members to an institutionalized system supported by the University. The most significant lessons learned to date include the requirement for a Web-enabled content management system to ease posting of information to the website and the need to adjust administrative policy to encourage faculty to take on and integrate Knowledge Net related activities into their ongoing academic responsibilities. (Author)

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NDU Knowledge Net:
A Web-Enabled Just-In-Time Information Service for Continuing Education

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Abstract: This paper describes the development of a web-enabled information service for constituents of the Information Resources Management College. The constituents of the College, who include graduates, current students, and prospective students, typically work in the Chief Information Officer (CIO) office of United States federal agencies. The web-enabled information service, known as "Knowledge Net," is intended to tie the College constituents located throughout the world into a virtual community – sharing technical information, emerging problems, and potential solutions. Knowledge Net has evolved over a three-year span from a skunk-works project of several faculty members to an institutionalized system supported by the University. The most significant lessons learned to date include the requirement for a web-enabled content management system to ease posting of information to the website and the need to adjust administrative policy to encourage faculty to take on and integrate Knowledge Net related activities into their ongoing academic responsibilities.

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Introduction

The Information Resources Management (IRM) College of the National Defense University is, in a sense, a Corporate University for information technology executives in the Department of Defense (DOD) and other federal agencies. The IRM College, located in Washington D.C., offers several graduate-level programs dealing with policy, strategy, development, and management of information technology systems.

One of the major programs offered by the College is the Chief Information Officer (CIO) Certificate program. This program, attended by mid-to-senior level managers in the Department of Defense as well as all other federal agencies, leads to a CIO Certificate acknowledged by the Federal CIO Council. The certificate attests that graduates of the program have received education in the skill and knowledge required of federal Chief Information Officers. Also, students completing the program earn 15 graduate-level credit hours that can be applied towards Master's Degrees at several civilian institutions. The students earn the CIO Certificate by successfully completing eight of approximately 20 graduate-level courses from ten defined competency areas: *policy, strategic planning, leadership, process improvement, capital planning, performance measurement, technology assessment, systems architecture, security*, and *system acquisition*.

Like many other corporate universities, the IRM College conducts its courses face-to-face and via an asynchronous distributed education. However, in its continuing education role for our primary constituents, the College recognized that formal courses (residential and distributed) are only one way of meeting their ongoing information needs. There are perhaps twenty thousand people worldwide serving in the CIO organizations of DOD and other federal agencies. The IRM College has the capacity for handling a maximum of 2,000 students per year. How should the College support the other 18,000 individuals? How can it better serve the graduates of its program?

These twenty thousand people are also in need of continuing development and support. They work in the field of information technology that changes radically, not just in the superficial "bells and whistles" of the

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systems, but even more so in the requirements for management oversight. How will conversion to a wireless strategy change the fundamental way business is accomplished? How can the greater demand for information security be balanced with increasing concerns of information privacy? The people who work in federal CIO organizations worldwide are continually bombarded with new demands and challenges for which they were unprepared by educational programs taken just six months earlier. Curriculum development activities at the IRM College indicate that about half of the program content must be significantly revised each year. In addition, even though there is a commonality of issues through which all members of federal CIO staff must work – whether at an outpost in Korea or at a government research facility in North Carolina – each unit tends to do so individually, on its own. Historically, there has been no community by which federal CIO staff can share common problems and solutions. With the exception of the infrequent periods of time when some of them are jointly enrolled in courses at the IRM College, they are on their own – keeping up with the technology as best they can, testing out their own solutions until their next opportunity to occupy one of the limited slots for attendance at the IRM College.

The Information Service

The emergence of the World Wide Web, its growing accessibility, and rapidly developing functionality offer a supplemental approach for achieving the mission of continuing education. The model conceived to take advantage of the evolving capabilities of the Web - beyond conducting formal courses online - has been designated as the NDU Knowledge Net (http://www.nduknowledge.net/). The NDU Knowledge Net is a web-enabled service seen as an alternative Information Age strategy for the University to deliver just-in-time continuing education to its constituency. As originally conceived, it provided the following web-enabled services for each of the ten competencies identified by the Federal CIO Council:

- FAQs: Frequently Asked Questions and answers concerning fundamental concepts
- NEWS: Summary and links to recent developments concerning the competency
- GUIDES: Software tools, decision aids, and "How to" guidelines to do things.
- EVENTS: Links to training/educational programs and conferences related to the competency
- EXAMPLES: Success stories and sample products of real-world applications
- RESOURCES: Annotated links to related references on the Web

Two additional services were envisioned for the information service:

- FORUM: Threaded discussions on topical issues facilitated by faculty and users
- LIVE: Entry to scheduled real-time discussions and briefings on topical issues

The home page for the original Knowledge Net provided direct access to each of the ten competency areas (e.g., *policy, strategic planning, leadership,...*). Access was also provided to a search engine for searching all the Knowledge Net content, a statement of the web policy governing the Knowledge Net web site, a glossary of terms associated with the CIO position, and links to related sites.

When the user clicked on the name of a competency on the home page, the *NEWS* page for the selected competency area opened. From here, the users had a number of options. They could...

- scroll down the summaries of articles until they find one in which they are interested, and then click on the arrow icon to open that article in a separate window.
- open a different kind of page for the same competency (e.g., *EVENTS, GUIDES,...*) by clicking on one of the tabs near the top of the display.
- access the same kind of page in another competency area (e.g., *Policy, Strategic Planning, Leadership,..*) by clicking on one of the icons at the top of the page .
- access any of the general purpose pages (e.g., *search, glossary, contact us,...*) by clicking on an appropriate section of the image map in the upper left section of the display.

Each of the other kinds of pages has the same functionality as the *NEWS* page.

One Content Manager was responsible for each of the ten CIO competency areas. Volunteer faculty members with technical specialties in the associated competency accomplished these roles. They searched for relevant content, in part to support their normal course development and teaching duties, and in part to maintain the currency of the Knowledge Net competency web pages for which they are responsible. To assist them in this role, a pool of students doing independent study courses in related topics and research assistants was made available to them. They were also encouraged to establish special interest groups composed of other faculty, alumni, and practitioners in the field to feed them relevant sources of information. Content Manager are also provided with an account for a software agent under their control that continually crawls the web and reports back on a periodic basis with updates to its discovery of relevant content.

As the Content Managers identified items for their Knowledge Net area, they entered the required information into an electronic form designed for this purpose. Their submissions were entered into a database. At this time, items were uploaded from the database to the Knowledge Net server manually by a Webmaster, to allow for a quality control check.

The faculty member who conceived the idea of Knowledge Net served as its coordinator. His primary roles were to coordinate the activities of the Content Managers, provide quality control over the website, and serve as a catalyst for continual improvement and redesign of the site. He was supported by a Graduate Research Assistant who acted as the Knowledge Net Webmaster. Site statistics were made available from the external website hosting service, and mechanical checks on the site were conducted periodically by a subscription service looking for broken links, misspellings, and sources of excessive downloading times. Regular meetings were conducted with the Content Managers and typical users to help identify opportunities for improvement.

Lessons Learned

The initial phase of Knowledge Net development covered in this paper is restricted to the web publishing function – the posting of relevant information for users. The discussion and streaming capabilities will be introduced into Knowledge Net later this year.

In the earliest stage, Knowledge Net was hosted on a local University server. The Content Managers created and updated pages (*News, Events*, ...) associated with their assigned competency area using a web editor software package (i.e., Frontpage). Updated pages were sent to the University Webmaster who in turn would upload the pages to the server. This approach proved disastrous. Firstly, although IRM College faculty members are quite proficient in management concepts associated with information technology, their expertise with web editors varied considerably. The updating process required that the Content Managers first download the current page from the web server (to assure that the page being revised included all current changes), update it with the web editor, and then send it to the Webmaster for uploading back to the server. This did not always happen this way. Occasionally, a Content Manager would update the web page on his or her local drive and send it to the Webmaster without first downloading the most current page from the server. If the page on the server was a more recent version than the page on the Content Manager's local drive, this action would overwrite previous changes and corrections. In other words, configuration management of the website was a nightmare. Plus, the lack of capability with web editors by some Content Managers led to some very strange looking web pages uploaded to the server.

Another problem associated with this early stage in Knowledge Net development was its dependence on University assets – the University Webmaster and the hosting of the website on the University web server. As an experimental project of the IRM College, Knowledge Net was not high on the list of University priorities. The University Webmaster was managing multiple web projects, some of great concern to the University senior administration. It was not unusual for pages updated by the Content Managers to remain on the Webmaster's system for a week or more waiting to be uploaded to the web server while the Webmaster attended to more pressing University duties. Also, periodic weekend maintenance of the University's systems made Knowledge Net frequently inaccessible to users.

Both these problems were solved fairly easily by hiring a part-time Graduate Research Assistant as the Knowledge Net Webmaster and outsourcing the hosting of Knowledge Net to an external organization at a cost of about $200 per year. The website is now available 24/7 with rare periods of inaccessibility. The new Knowledge Net Webmaster quickly created simple web-based transaction forms and scripts to elicit new content items from the Content Managers. In this situation, a Content Manager wishing to update a page with new information accesses a web-based form customized to the type of page being updated. After entering the requested data (e.g., *title, date, link, summary*), the Content Manager can preview the appearance of the new item and then click on the Submit button to send it to the Webmaster. Content management no longer required the use of web editors and configuration management was completely in the hands of the Webmaster. The Webmaster was asked to upload new items to the server within three days of receipt, a requirement that was generally met except during periods of illness, vacation, and competing academic pressures on the Research Assistant. More recently, the Webmaster created a new system in which new items submitted by the Content Managers are entered directly into a database that, in turn, generates the updated web pages on the fly. In other words, as soon as a Content Manager submits a new item, it is immediately displayed on the Knowledge Net website. Content Managers now also have the ability to edit and delete items from the database themselves. They are now, indeed, *content managers*.

Another problem led to a major overhaul of the Knowledge Net website this year. Up until recently, the Knowledge Net areas (e.g., *Strategic Planning, Capital Planning,...*) were based on the ten competencies originally specified for Department of Defense CIO's. As such, ten IRM faculty members were recruited to serve as Knowledge Net Content Managers, one for each competency. The selected faculty members undertook this new incremental task with varying degrees of enthusiasm. Some were highly excited about the prospect of managing a portion of a website devoted to a content area associated with their own intellectual pursuits. These faculty members saw their content management responsibility as an opportunity, spending several hours a week in the search for new relevant content, publishing new items almost every day, and integrating the website into their academic courses as a major information resource. However, other faculty members were more reluctant to embrace their content management responsibility. They seemed to see their role in Knowledge Net as a burden, almost a distraction to their ongoing academic duties. As a result, the content on web pages associated with these competency areas might not be updated for weeks on end. This is a serious problem for a web-based information service such as Knowledge Net. Websites of this sort must have fresh content in order to attract and bring visitors back. At the request of the Knowledge Net Coordinator, the College administration granted teaching load credit for Content Managers. It was hoped that the ability to reduce teaching hours in return for work done on Knowledge Net would both free up the necessary time and serve as an incentive. Moreover, the granting of contact hours gave recognition that Knowledge Net was a legitimate and important service of the College. Unfortunately, this management action had virtually no affect on the frequency with which web pages of the various competency areas were updated. The pace of activity on Knowledge Net by both groups of Content Managers – those who saw it as an opportunity and those who saw it as a problem – went on as it was.

The proposed solution to this issue led to a redesign of Knowledge Net. The number of competency areas has been collapsed from ten to six and these six areas are now aligned with the organizational structure of the College. The six areas are now *e-Government, Performance Management, Enterprise Architecture, Systems Acquisition, Technology Capabilities*, and *Information Assurance*. Each of the three academic departments in the College now has responsibility for two Knowledge Net areas, and two of the areas - *e-Government* and *Information Assurance* – are each aligned directly with a center of excellence at the College. Department Chairs at the IRM College have supervisory responsibility over faculty (i.e., they play a prominent role in hiring, contract renewal, work assignment, promotions, and bonuses). The redesign was based on the belief that a more consistent level of performance will be attained by reducing the number of required Knowledge Net Content Managers (i.e., it should be easier to find six personally motivated faculty members than ten such individuals) and by delegating their selection and management to the Department Chairs. This change was initiated about three months ago and, although performance has been more consistent, it is too early to declare a success. Everyone is still exploring the requirements and practices of his/her new responsibilities.

The redesign of Knowledge Net also involves the following changes that are expected to be completed by the end of 2002:

- Redesign of the pages for a common look & feel consistent with a new IRM College website.
- Reduction in the number of kinds of pages for each competency (*Basics, Articles, Events,*

Documents, Websites), which are easier to distinguish among than the previous page types.

- Introduction of a more powerful search engine.
- Addition of a threaded discussion capability to be facilitated by the Knowledge Net Coordinator, with the voluntary assistance of other Content Managers, to enable users to share field problems and solutions with each other.
- Ability of users to suggest sources and items for inclusion into Knowledge Net.
- Presentation of scheduled lectures by faculty and guest speakers of the IRM College using streaming video.

Conclusions

The existence of Knowledge Net offers a number of benefits to the College and its constituents.

Benefits to the Constituents of the College

Knowledge Net enables the 20,000 thousand people working in federal CIO officers to continue their professional development, even when they are unable to enroll in formal College courses. They have access to current information about the field anytime and from anywhere – information that has been selected and filtered by faculty experts in the CIO competency. When the full functionality of Knowledge Net comes online in 2002 with streaming video and discussion boards, users will also be able to hear and see guest speakers at the College talk about advanced topics related to the field, and discuss issues with faculty, peers, and experts around the world.

Moreover, Knowledge Net benefits the College's constituents by helping improve their job performance – it serves as a kind of electronic performance support system. Users can stay abreast of late breaking news concerning CIO responsibilities. They can more easily find resources to help do their jobs, just when they need them. Using the discussion boards, they can note how things should be done and how others are actually doing them – noting what works and what does not. They can even collaborate with others doing the same kinds of things no matter where they are doing them.

Benefits to the Institution

The mission of the IRM College is to "prepare military and civilian leaders to direct the information component of national power by leveraging information and information technology for strategic advantage." Note that the mission says nothing about preparing these leaders by means of educational programs. Knowledge Net is an alternative means to accomplish the College's mission, one that is likely to play an even more prominent role in the future.

Knowledge Net also benefits the College by strengthening its relationship with its constituents. Certainly, the information available on Knowledge Net is a resource available to students currently enrolled in courses, both residential and online. It provides a searchable database of relevant information useful for papers required in the academic programs. As mentioned previously, Knowledge Net is also available to graduates of our programs for continuing education and development. Alumni thereby remain connected to the College long after graduation. Knowledge Net can even be used to promote the College programs. Many of the 20,000 people working in federal CIO organizations are unaware of the IRM College's existence and the availability of the CIO Certificate program. If Knowledge Net is perceived as a useful tool on the job, its association with the IRM College can continually attract new students.

Implications For Other Organizations

The Knowledge Net strategy being developed by the IRM College seems to have value for other corporate universities, provided they see their missions as developing and supporting the job performance of constituents, rather than just conducting training and education courses. In a similar vein, professional

associations whose members share a common set of competencies can also apply the strategy. Even subject-specific centers of excellence resident in institutions of higher learning can implement a Knowledge Net-type website to benefit both their constituents and the center itself. In fact any organization seeking to support constituents with a common set of competencies and that possess a group of specialists who are willing to adapt web technology to serve their role can implement a Knowledge Net strategy.

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